AREA 126

BIRD

INSTRUCTION book

8400 SERIES

MP MASTER
MA26580

INSTRUCTION MANUAL
for
8400 SERIES
TERMALINE® LOAD RESISTORS

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WARRANTY

LIMITED WARRANTY

We are proud of the high quality of our product and we warrant it to the original purchaser that each new instrument of our manufacture will for a period of one year after original shipment be free from defects in material and workmanship under normal and proper operating conditions and that properly used during such period it will perform in accordance with our applicable specifications.

Our obligation and the purchaser's exclusive remedy for any defect or failure to meet specifications shall be limited, at our options, to repair or replacement or, if we determine said defect or failure to be so defective as to preclude remedying by repair or replacement, the purchaser's sole and exclusive remedy shall be limited to refund of the the purchase price. We shall have no obligation if defects result from improper use, operation above rated capacities, repairs not made by us, or misapplication of the equipment. Our warranty does not extend to the failure of semiconductor devices and batteries, or to equipment and parts made by others except to the extent of the original manufacturer's warranty to us. No other warranty is expressed or implied. Bird Electronic Corporation is not liable for consequential damages.

Warranty returns must be first authorized by the factory office and are to be shipped prepaid.

SAFETY PRECAUTIONS

****
* C A U T I O N *
* *
* This equipment is designed for operation in a horizontal posi-*
* tion only, with mounting brackets down. DO NOT OPERATE IN *
* ANY OTHER MANNER. *
****

****
* C A U T I O N *
* *
* DO NOT continuously operate this equipment above the rated *
* 600 watts. *
****

****
* W A R N I N G *
* *
* Never attempt to disconnect the load from the transmission *
* line while RF power is being applied. Leaking RF energy is *
* definitely a dangerous health hazard. *
****

****
* W A R N I N G *
* *
* To avoid painful burns, be wary of touching the cooling fins *
* of the load if the equipment has been operating for sometime *
* in its upper ranges of power dissipation. *
****

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8400 SERIES TERMALINE® LOAD RESISTOR

INTRODUCTION

PURPOSE AND FUNCTION

The Bird Models 8401, 8402 and 8404 TERMALINE® Load Resistors are portable, general purpose 50-ohm coaxial transmission line terminations. They are self-contained units requiring no outside power source or additional equipment. These Loads provide accurate, dependable, and practically non-reflective terminations for testing and adjusting transmitters under non-radiating conditions from DC to 3000 MHz.

They are useful for the following purposes: -

a. As a substitute antenna.

   1. For tuning transmitters - under non-radiating conditions.

   2. For making routine tests and adjustments.

b. As a substitute for any circuit loading Element.

c. To measure, with a suitable indicating device, the power output of any coaxially transmitted signal within their rating.

PERFORMANCE CHARACTERISTICS & CAPABILITIES

The Models 8401, 8402 and 8404 will absorb up to 600 watts of RF energy continuously and dissipate it harmlessly as heat. As terminations they show a VSWR of 1.1 to 1.0 from DC to 1000MHz, 1.2 to 1.0 from 1000 to 2800MHz and 1.3 to 1.0 from 2800 to 3000MHz.

They are rectangular in shape with transverse fins encasing an oil-filled coolant cylinder. A retractable handle is recessed in the radiator fins. Extra thick fins at front and rear are bent 90° to form bottom mounting flanges. These flanges are supports for free standing use, or brackets for fixed mounting. Flange holes are provided for this purpose, see Installation, Section I.

The RF input connector on the front face is a patented "Quick-Change" design allowing rapid and easy interchange with other AN type connectors, See Section IV Maintenance.

DIMENSIONS AND WEIGHT

All three models have the same dimensions: 16-1/16"L x 5-15/16"W x 8-1/2"H (408 x 151 x 216mm). They weigh 19.6 lbs. (8.9kg). Their shipping weight is about 25 lbs. (11.25kg).

POWER AND UTILITY REQUIREMENTS

Models 8401, 8402 and 8404 Load Resistors are passive RF components that do not need any external source of power or utilities to function.

ENVIRONMENTAL REQUIREMENTS

These loads are not intended for use outdoors where they would be exposed to the elements. They should be used indoors in a clean, dry, dust and vibration free environment. The ambient temperature should be maintained between -40°C and +45°C (-40°F and +113°F) for proper operation. At least a foot of clearance around the radiator should be provided so that the flow of convection air currents is not impeded.

LIST OF ITEMS FURNISHED

The Model 8401 is normally supplied with a female N type QC Connector P/N 4240-062. The Model 8402 is supplied instead with a female C type QC Connector P/N 4240-100 equipped with dust cap secured by a ball chain anchor. Also, the Model 8402 differs from the Models 8401 and 8404 by having no handle on the radiator. The Model 8404 differs from Model 8401 in being supplied additionally with a Male N/Male N adaptor (with dust cap) attached by a ball chain anchor. This instruction book is the only other item furnished.

LIST OF ITEMS REQUIRED

No additional items are needed other than to have the coaxial transmission line fitted with the proper mating connector.

TOOLS AND TEST EQUIPMENT

Only simple tools like screwdrivers are needed to disassemble an 8400 Series Load. A 1% or better resistance bridge such as the Leeds and Northrop 5305 Test Set is useful for checking the resistance value of the RF section assembly.

SPECIFICATIONS FOR 8400 SERIES TERMALINE® LOAD RESISTORS

Impedance	50 ohms nominal
VSWR	1.1:1.0 max. dc to 1000MHz 1.2:1.0 max. 1000-2800MHz 1.3:1.0 max. 2800-3000MHz
Connectors	
Model 8401	Female N "QC" type normally supplied
Model 8402	Female C "QC" type with cap normally supplied
Model 8404	Same as 8401 plus UG-57G/U and cap
Power Range	600W continuous
Frequency Range	dc to 3000MHz
Dimensions	16-1/16"L (without input connector) x 5-15/16"W x 8-1/2"H (408 x 151 x 216mm)
Ambient Temperature	-40°C to +45°C (-40°F to +113°F)
Cooling Method	Oil dielectric & convection currents
Weight	19.6 lbs. (8.9kg)
Operating Position	Horizontal only
Finish	Light Navy Grey Baked Enamel (MIL-E-15090B)

SECTION I - INSTALLATION

1-1. LOCATION

1-2. Locate the Model 8401, 8402 or 8404 TERMALINE® Load Resistor to provide at least a foot of free space around and above the unit. Place the load to permit the shortest possible cable length between the unit and the transmitting equipment. Operate these loads in a horizontal position only, with the handle on top.

1-3. MOUNTING

1-4. These loads may be used for portable operation or for fixed installation, that is, they may stand free or may be secured to a bench or any convenient flat surface. The front and rear fins are made of heavier gauge material bent outward 90° to form mounting flanges. If it is desired to fasten the load by means of its base mounting flanges, four 9/32" holes, for use with screws up to 1/4" in diameter, are provided. These holes are arranged in a 5-1/8" x 14-5/8" rectangle (130.2 x 371.5mm).

```
**********************************************************************
*                          C A U T I O N                             *
*                                                                    *
* This equipment is designed for operation in a horizontal posi-     *
* tion only, with mounting brackets down.  DO NOT operate in         *
* any other manner.                                                  *
**********************************************************************
```

SECTION II - THEORY OF OPERATION

2-1. GENERAL

2-2. The Models 8401, 8402 and 8404 TERMALINE® Loads consist essentially of carbon film-on-ceramic resistors immersed in a dielectric coolant. The resistor, individually selected for its accuracy, is enclosed in a special exponentially tapered housing. This provides a linear reduction in surge impedance directly proportional to the distance along the resistor. When surrounded by the dielectric coolant, the characteristic impedance is therefore 50 ohms at the front (connector end), 25 ohms at the mid-point to compensate for the resistance already passed over, and zero ohms at the rear where the resistor joins the housing, forming the return conductor of the coaxial circuit. This produces a uniform, practically reflectionless line termination over the stated frequencies of the load resistor.

2-3. COOLING

2-4. The dielectric coolant is chosen for its desirable dielectric and thermal characteristics. Cooling of the Models 8401, 8402 and 8404 is accomplished by natural fluid and air convection currents. The 0.7 gallons of dielectric coolant carry the electrically generated heat from the resistor to the walls of the cylindrical cooling tank. This tank is encased in a set of radiating fins, constructed from heavy gauge aluminum alloy, and firmly pressed on to the cylinder. The heat from the dielectric oil is transferred to the surrounding air by the fins.

2-5. Expansion of the coolant with the rise in temperature is allowed for by means of a synthetic rubber diaphragm (not visible) in the rear cover dome of the unit.

SECTION III - OPERATING INSTRUCTIONS

3-1. USE AND FUNCTION OF CONTROLS

3-2. The 8401, 8402 and 8404 TERMALINE® Load Resistors, being passive devices, have no indicators or controls.

3-3. INITIAL ADJUSTMENTS AND CONTROL SETTINGS

3-4. As in paragraph 3-2 above, no adjustments are required.

3-5. START-UP

3-6. Connect the Load to the transmitting equipment under test with 50 ohm coaxial cable such as RG-8A/U, RG-9B/U, RG-213/U, or equal, and a Male N type plug (UG-21E/U or equal) which mates with the RF input connector of the load. After the transmitter has been connected to the load, proceed according to the equipment manufacturer's instruction. When reconnecting the antenna, it may become necessary to slightly readjust the transmitter due to possible differences in VSWR between the load and the antenna system.

3-7. NORMAL OPERATION

3-8. Having no indicators or controls, the dummy load requires no special operating procedures or surveillance when properly used.

****
* WARNING *
* *
* To avoid painful burns, be wary of touching the cooling fins *
* of the load if the equipment has been operating for sometime *
* in its upper ranges of power dissipation. *
****

3-9. OPERATION UNDER EMERGENCY, ADVERSE OR ABNORMAL CONDITIONS

3-10. The unit will sustain an input moderately greater than 600 watts for short periods of time. Such loading must be spaced at reasonable intervals to allow time for cooling to a safe temperature.

****
* CAUTION *
* *
* DO NOT continuously operate this equipment above the rated *
* 600 watts. *
****

3-11. SHUT-DOWN PROCEDURE

3-12. Because a dummy load is a passive device, there is no way to turn it off. RF power must be cut off at its source.

3-13. EMERGENCY SHUT-DOWN PROCEDURE

3-14. Turn off the source of RF power.

```
**********************************************************************
*                        W A R N I N G                               *
*                                                                    *
* Never attempt to disconnect the load from the transmission         *
* line while RF power is being applied.  Leaking RF energy is        *
* definitely a dangerous health hazard.                              *
**********************************************************************
```

SECTION IV MAINTENANCE

4-1. TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	REMEDY
Leakage of coolant oil around clamping band or radiator housing	Clamping band not tight	Tighten slightly with screwdriver
	Faulty O-ring (front)	Replace per Paragraph 4-11,c
	Faulty diaphragm (rear)	Replace per Paragraph 4-11,b
Excessive overheating of the radiator	Transmitter power too high	Reduce tramsmitter power
	Coolant oil level too low	Add more coolant oil to the radiator per Paragraph 4-11,b
	Faulty RF section assembly	Replace per Paragraph 4-11,c
High or low DC resistance values per Paragraph 4-9	Faulty RF input connector	Replace per Paragraph 4-11,a
	Loose RF input connector	Tighten with a screw-driver
	Faulty RF section assembly	Replace per Paragraph 4-11,c
	Coolant oil level too low	Add more coolant oil to the radiator per Paragraph 4-11,b

4-2. CLEANING

4-3. The principle maintenance required by the operator will be the cleaning of the radiator fins. Wipe them periodically with a soft clean cloth to remove the accumulated dust and grime. If the insulator or metallic contact surfaces of the connector should become dirty or grimy, clean them carefully also with a clean cloth. Use a self drying non-residue forming contact cleaner on the inaccessible portions of the connector.

4-4. INSPECTION

4-5. With the rugged and simple construction of the Models 8401, 8402 and 8404 TERMALINE® Loads, periodic inspection will be necessary at only about six month intervals. Inspection should include the items listed below:

a. Oil Leakage - Check for coolant oil seepage around the radiator tank, particularly at the front and back around the underside of the clamping band. See paragraph 4-1 Troubleshooting of this section if leakage is observed. Check the tightness of the clamping screw and the fasteners around the front cylinder.

b. Inspect the TERMALINE® Load for completeness and general condition of the equipment.

c. A Troubleshooting chart paragraph 4-1 of this section lists the symptoms of commonly encountered troubles, causes, and suggested corrective measures. Use this chart as a guide when analyzing symptoms.

4-6. PREVENTIVE MAINTENANCE

4-7. The major requirement for preventive maintenance is to keep the equipment clean, particularly the radiator fins (see paragraph 4-3 Cleaning in this section). If any portions of the radiator are corroded or rusted, clean the area with a fine flint sandpaper, and touch up with grey enamel. It is important to maintain the heat transfer efficiency of the cooling fins.

4-8. CALIBRATION

4-9. Check the condition of the load resistor by accurate measurement of the DC resistance between the inner and outer conductors of the RF input connector. Use a resistance bridge with an accuracy of 1% or better at 50 ohms (such as the Leeds & Northrup 5305 Test Set). The measured resistance should be a nominal 50 ohms, $\pm$2 ohms. It should not deviate by more than $\pm$1 ohm from the value on the attached white tag.

4-10. DISASSEMBLY

4-11. There are no special techniques required for the repair or replacement of components in the TERMALINE® Loads. A screwdriver is the only tool needed. The paragraphs below outline component removal.

4-12. RF Input Connector Replacement - The input connector is a "Quick-Change" design which permits easy interchange with the use of only a screwdriver. This process does not interfere with the essential coaxial continuity of the load resistor RF input or the coolant oil seal. For replacement, proceed as follows:

a. Remove the four #8-32 x 5/16" round head machine screws from the corners of the RF connector.

b. Pull the connector straight out of its socket.

4-13. Diaphragm and Coolant Oil - Remove the diaphragm to replace or examine the coolant oil. Replacement of the diaphragm and coolant oil are listed in the steps below:

a. Stand the load vertically, with the back end up.

b. Loosen the clamp screw until the clamping band is released.

c. Remove the diaphragm cover and lift the diaphragm from the back end of the radiator tank. Inspect the diaphragm; it should still be soft and pliable. If it has hardened or shows signs of surface cracks, replace it.

d. The coolant oil level should be about one inch below the top of the radiator cylinder. If the oil appears to be contaminated, i.e., does not have a clear light yellow color, replace it.

4-14. RF Load Resistor Assembly - To replace the load resistor assembly, first remove the diaphragm and coolant oil per paragraph 4-12 above, and proceed with the steps below:

a. Pour the coolant oil into a CLEAN container.

b. Set the load on its mounting feet.

c. Loosen and remove the four #8-32 x 5/16" oval head machine screws from around the cylinder (RF input connector end).

d. With one hand, hold the load assembly by the RF input connector, using the other hand, push the assembly (from inside the radiator housing) out of the radiator.

e. Inspect the O-ring seal which is located just inside the mounting flange of the resistor assembly. Do not reuse the O-Ring if it is no longer pliable or shows signs of surface cracks.

4-15. REASSEMBLY

4-16. To install a new connector, reverse the procedures given in paragraph 4-12 RF Input Connector Replacement. Be sure that the projecting center contact pin on the connector is carefully engaged and properly seated with the mating socket of the load resistor input.

4-17. To reassemble the load after inspecting the diaphragm and coolant oil (Paragraph 4-13 Diaphragm and Coolant Oil) proceed as follows:

a. Put the diaphragm back in place on the radiator tank.

b. Press the cup-like swelling in the center of the diaphragm down into the tank to remove the trapped air bubble. To allow the air to escape, pry the diaphragm away from the edge of the tank. Through the same opening add more oil, if necessary, until the oil level is flush with the top of the tank.

c. Replace the diaphragm cover and the clamping band. Retighten the clamping screw.

4-18. To replace the RF load resistor assembly reverse the procedure given in paragraph 4-14 RF Load Resistor Assembly. Guide the RF section into place from inside the radiator.

4-19. REPAIRS

4-20. If repairs are required, other than those described preceding sections, then the load must be returned to Bird Electronic Corp. for service. Consult the factory.

SECTION V - PREPARATION FOR RESHIPMENT

5-1. GENERAL

5-2. Wrap the RF Connector with padding and tape in place. Pack and brace the load in a suitable shipping container. A sturdy wooden crate is recommended. It is not necessary to remove the coolant for shipment.

SECTION VI - STORAGE

6-1. GENERAL

6-2. No special preparation for storage is required except to cover the load to keep the dust off. Store in a clean, dry and dust free as environment as possible. The ambient temperature should preferably remain within the -40°C to +45°C (-40°F to +113°F) normal working range of the load.

SECTION VII - REPLACEMENT PARTS LIST

7-1. GENERAL

ITEM	QUANTITY REQUIRED	DESCRIPTION	PART NUMBER
1	1	Radiator Assembly (Models 8401 and 8404)	2440-001-1
2	1	Radiator Assembly (Model 8402)	2440-013
3	1	RF Section Assembly	8401-002
4		Dielectric Coolant 0.7 gallons (2.65 l)	5-030-3 (1 gallon container)
5	1	Connector: Female N, "QC" Type (Model 8401 & 8404)	4240-062
6	1	Connector: Female C, "QC" Type (Model 8402)	4240-100
7	1	Connector Cap with Chain (Model 8402)	8402-002
8	1	Diaphragm	2430-015
9	1	Cover, Diaphragm	2430-148
10	1	Clamp Band Assembly	2430-043
11	1	O-ring, Seal	5-453
12	1	Filler Plug	7500-040
13	1	O-ring, Filler Plug	8110-041
14	1	Handle, Radiator (Omitted from Model 8402)	2440-009
15	1	Adaptor male N to Male N (Model 8404)	5-790-1
16	1	Dust Cap for Male N (Model 8404)	5-297

Available QC Type Connectors

N-Female	4240-062	LT-Female	4240-018
N-Male	4240-063	LT-Male	4240-012
HN-Female	4240-268	C-Female	4240-100
HN-Male	4240-278	C-Male	4240-110
LC-Female	4240-031	UHF-Female(SO-239)	4240-050
LC-Male	4240-025	UHF-Male(PL-259)	4240-179

7/8" EIA Air Line 4240-002

QUALITY INSTRUMENTS FOR RF POWER MEASUREMENT

From 2 to 2300 MHz and from 25 milliwatts to 250 kilowatts in 50-ohm coaxial line systems.

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TERMALINE

ABSORPTION WATTMETERS

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